

Service Manual for Volumetric Pump

green stream[®] VO-P

ARGUS 414

Made in Switzerland



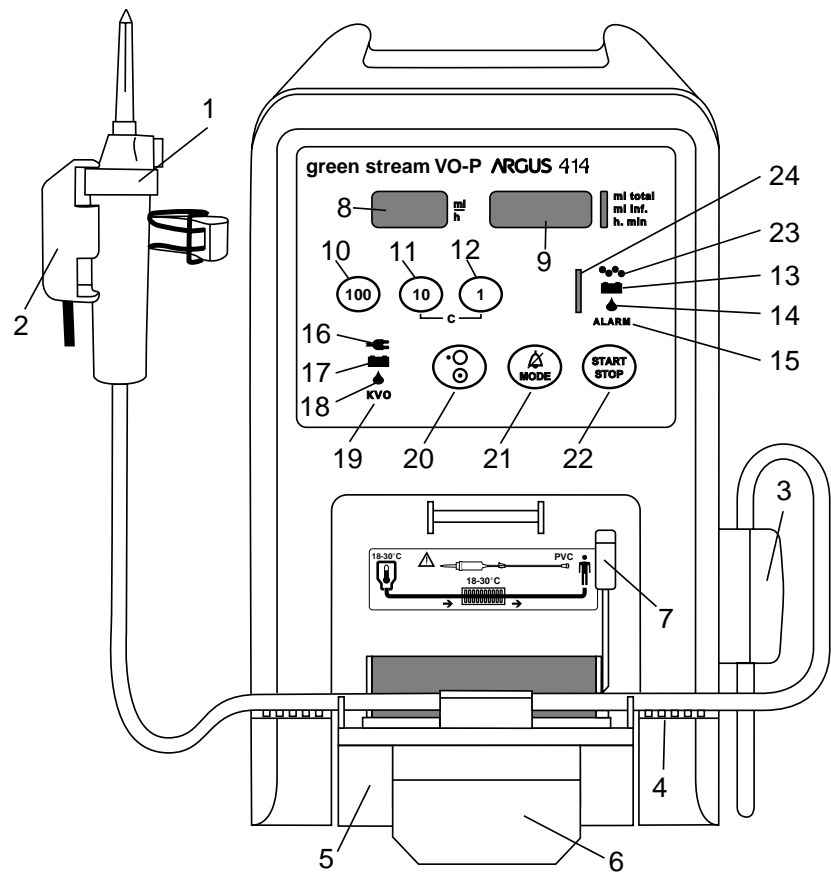
IMPORTANT

This service manual is intended for the exclusive use of authorized persons who have been trained by ARGUS Medical AG in the maintenance and repair of the infusion apparatus mentioned above.

ARGUS Medical AG shall not assume any responsibility for any manipulations which have been carried out on the unit by a non-authorized person.

ARGUS Medical AG, CH-3627 Heimberg/Switzerland
(A member of the CODAN group)

- 1 Drip chamber
- 2 External drop detector
- 3 Air detector
- 4 Tube guide
- 5 Door (opened)
- 6 Door handle
- 7 Stop flow lock
- 8 Display "infusion rate"
- 9 Display "total"
- 10 "100"-key
- 11 "10"-key
- 12 "1"-key
- 13 Battery discharged
- 14 Occlusion/bottle empty
- 15 ALARM
- 16 Line operation
- 17 Battery operation
- 18 Drop indicator
- 19 KVO-operation
- 20 "ON/OFF"-key
- 21 "MODE"-key
- 22 "START/STOP"-key
- 23 Air
- 24 Display "Pressure"



- 30 Bottle holder
- 31 Staff alert connector
- 32 Interface connector RS232
- 33 External drop detector connector
- 34 Spindle for clamp
- 35 Screw for bottle holder
- 36 Line plug
- 37 Line fuse
- 38 Ground terminal
- 39 Clamp

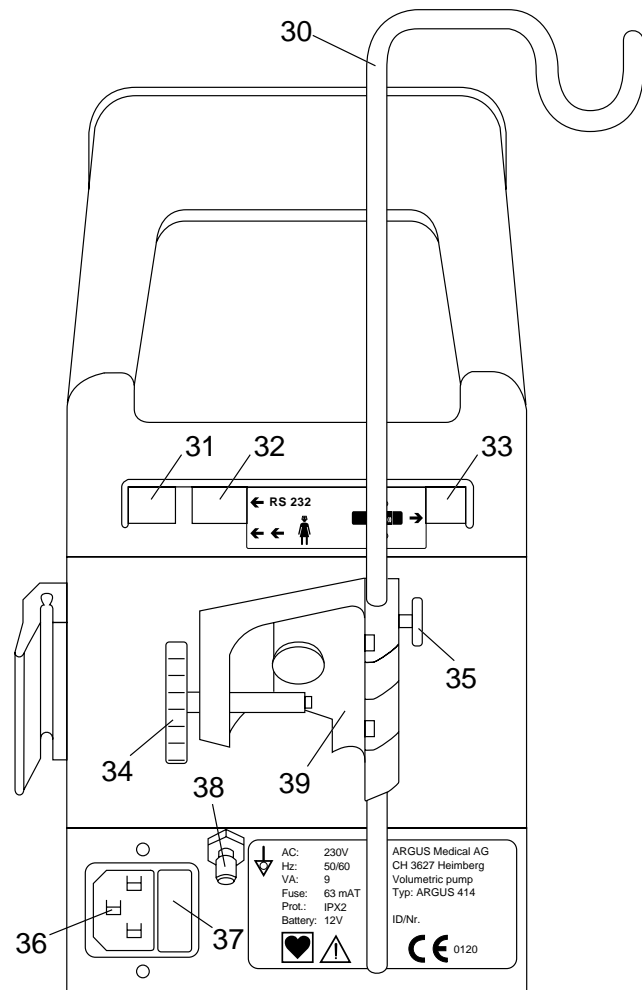


Table of contents

	Page
1 Special key inputs and configurations	4
2 History and pump configurations printout	13
3 Fault finding	17
4 Replacement of parts	18
5 Safety standard check	23
Mechanical drawings	24
Wiring diagram	28
Bloc schematic	29

1 Special key inputs and configurations

1.1 Special key inputs:

Configuration

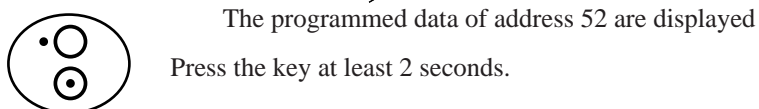
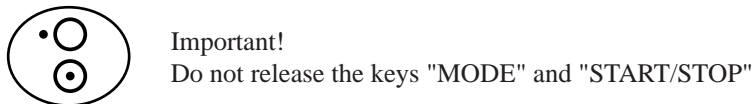
CAUTION! The configuration possibilities mentioned below constitute a modification of the pump and may only be carried out by authorized persons.

If the decimal points are flashing in a display, this display is ready to accept an input by means of the keys "100, 10, 1".

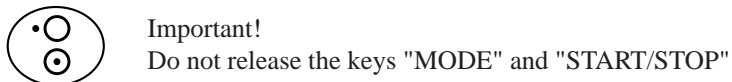
Input of the address in display (2)

Input of the values in display (3)

a Interrogation mode



1.2 Configuration mode without PIN code



If the data are accepted, entry changes to the left display.



1.3 Programming mode: first input of write protection (code)

IMPORTANT ! Remember to make a note of your code and keep it in a safe place.

	Key	Description	Display (8)	Display (9)
1	"MODE" & "START/STOP"	Keep both keys pressed before switching the unit on.	"414"	"prog"
2	"START/STOP"	Acknowledgement (write protection is inactive)	". . 0."	" 0"
3	"MODE"	Switch over to display (9)	" 0"	". . . 0."
4	"START/STOP"	Acknowledgement	"Cod"	" - - - - "
5	"MODE"	Switch over to display (9)	"Cod"	" 0"
6	"START/STOP"	Acknowledgement	". . 0."	" 0"
7	"MODE"	Switch over to display (9)	" 0"	". . . 0."
8	"100;10;1"	Enter 1 to 4 digit code	" 0"	" C.C.C.C."
9	"START/STOP"	Acknowledgement (write protection is active) Code is never visible	". . 0."	" 1"
10	"ON/OFF"	End of programming mode		

1.4 Programming mode with active write protection (code)

CAUTION! Only the code holder can carry out modifications when the write protection is active.

	Key	Description	Display (8)	Display (9)
1	"MODE" & "START/STOP"	Keep both keys pressed before switching the unit on.	"414"	"prog"
2	"START/STOP"	Acknowledgement (write protection is active)	". . 0."	" 1 "
3	"MODE"	Switch over to display (9)	" 0"	". . . 1."
4	"START/STOP"	Acknowledgement	"Cod"	" - - - - "
5	"100;10;1"	Enter code	"Cod"	" X X X X"
6	"START/STOP"	Acknowledgement	". . 0."	" 1"
7	"100;10;1"	Enter requested address Programmed data appear in display (9)	"A.A.A."	"X X X X"
8	"MODE"	Switch over to display (9)	" A A A"	" X.X.X.X."
9	"100;10;1"	Enter requested data	"A A A"	" Y.Y.Y.Y."
10	"START/STOP"	Acknowledgement.If the data are accepted, entry changes to display (8)	"A.A.A."	" Y Y Y Y"
11	"ON/OFF"	End of programming mode		

1.5 List of the interrogation- and configuration functions:

CAUTION! Before you make a new configuration or replace an EPROM or the mainboard make a note of the programmed values. Afterwards you can re-enter the old not writeprotected values.

Address (#)	Write prot.	Default Value	Function	
0		0 = No	PIN code active	
1		1 = Yes	Run indication by running decimal point	
2		0 = No	Key "ON/OFF" only at STOP valid	
3		0 = No	Rate change only at STOP valid	
4		0 = No	Key "STOP" delayed (time at #361)	
5		0 = No	2nd entry of rate (#3=1), rate calculation disabled.	
6		0 = No	Static alarm (staff alerting system)	
7		0 = No	Display elapsed time in run mode (#8=0)	****
8		0 = No	Select remaining time (#7=1)	
9		1 = Yes	Alternative time input (10h, 1h, 1/4h)	
10		0 = No	Operation without drop detector	
11		1 = Yes	Recall "ml/h" (rate) at next power on	
12		0 = No	Recall "ml total" (end volume) at next power on	
13		0 = No	Recall "ml inf." (volume inf.) at next power on	
14		0 = No	SBS Step By Step function	
15		0 = No	Display VTBI (Volume To Be Infused)	
16		0 = No	Display "SEt -X-" if only 1 set enabled	
17		1 = Yes	KVO (KOR), mode see #60	
18		0 = No	Drop alarm only if bottle is empty (#10=0)	
19		1 = Yes	Buzzer at start	
20		0 = No	Menu "CLr" (clear "ml inf.") (#15=0)	****
21		0 = No	Menu "uOP" (Micro operation)	****
22		0 = No	Menu "trA" (transport) (#10=0 and #18=0)	****
23		1 = Yes	Menu "PrL" (pressure alarm limit)	****
24		1 = Yes	Menu "CAP" (battery capacity)	****
25		0 = No	Menu "SEt Fill"	****
26		0 = No	Menu "InF" ("ml inf." since last power on)	****
27		0 = No	Menu "dLo" (data-lock)	****
28		0 = No	Menu "Stb" (stand-by)	****
29		0 = No	Menu "MEd" (medication number)	****
30		0 = No	Menu "tM " (timer alarm)	****
31		0 = No		
32		0 = No	Menu "boL" (release bolus)	****
33		0 = No	Menu "boLr" (bolus rate) (#32=1)	****
34		0 = No	Menu "tot" (bolus total) (#32=1)	****
35		0 = No		
36		0 = No		
37		0 = No		
38		0 = No	Bolus application automatic (#32=1 and #34=1)	
39		0 = No		
40		0 = No	Demo mode (all menus enabled)	****
41		0 = No	Clear "ml/h" after infusion completed	
42		0 = No	Clear "ml total" after infusion completed (#41=1)	
43		0 = No	Air volume accumulated (1ml over 0.5 hrs)	
44		1 = Yes	Automatic pressure release after occlusion	
45		1 = Yes	Pressure display 20/40/60/80/100% (Bargraph ON)	
46		0 = No	Bargraph with indicator (25% steps, #45=1)	
47		0 = No	Standby- and battery prealarm low volume	
48		1 = Yes	Flashing numeric display at alarm	
49		0 = No	Alarm acknowledge only with key "MODE"	

Address (#)	Write prot.	Default Value	Function
50		0 = No	Start with >= 1bar allowed
51		1 = Yes	Start without infusion set
52		1 = Yes	High resolution if calculated rate <100 ml/h
53		0 = No	Micro mode after power on as default (Clear = 0.0 ml/h)
54		0 = No	
55		0 = No	
56		0 = No	
57		0 = No	
58		0 = No	
59		0 = No	
60		0 = No	KVO only after infusion completed
61		0 = No	
62		0 = No	
63		0 = No	
64		0 = No	
65		0 = No	Clear and continue (#15=0)
66		0 = No	
67		0 = No	
68		0 = No	
69		0 = No	
100		0 = No	
101		1 = Yes	Set 1 enabled
102		0 = No	Set 2 enabled (Pressure sensor and volume calibration requested)
103		0 = No	Set 3 enabled (Pressure sensor and volume calibration requested)
104		0 = No	Set 4 enabled (Pressure sensor and volume calibration requested)
105		0 = No	
106		0 = No	
107		0 = No	
108		0 = No	
109		0 = No	
200		0 = No	
201		0 = No	
202		0 = No	
203		0 = No	
204		0 = No	
205		0 = No	
206		0 = No	
207		0 = No	
208		0 = No	
209		0 = No	Set 1 definition
210		0 = No	
211		0 = No	
212		0 = No	
213		0 = No	
214		0 = No	
215		0 = No	
216		0 = No	
217		0 = No	
218		0 = No	
219		0 = No	

Address (#)	Write prot.	Default Value	Function
220		0 = No	Set 2 definition
221		0 = No	
222		0 = No	
223		0 = No	
224		0 = No	
225		0 = No	
226		0 = No	
227		0 = No	
228		0 = No	
229		0 = No	
230		0 = No	Set 3 definition
231		0 = No	
232		0 = No	
233		0 = No	
234		0 = No	
235		0 = No	
236		0 = No	
237		0 = No	
238		0 = No	
239		0 = No	
240		0 = No	Set 4 definition
241		0 = No	
242		0 = No	
243		0 = No	
244		0 = No	
245		0 = No	
246		0 = No	
247		0 = No	
248		0 = No	
249		0 = No	
250		0 = No	Set 5 definition
251		0 = No	
252		0 = No	
253		0 = No	
254		0 = No	
255		0 = No	
256		0 = No	
257		0 = No	
258		0 = No	
259		0 = No	
260		0 = No	Set 6 definition
261		0 = No	
262		0 = No	
263		0 = No	
264		0 = No	
265		0 = No	
266		0 = No	
267		0 = No	
268		0 = No	
269		0 = No	

Address (#)	Write prot.	Default Value	Function	
270		0 = No	Set 4 definition	
271		0 = No		
272		0 = No		
273		0 = No		
274		0 = No		
275		0 = No		
276		0 = No		
277		0 = No		
278		0 = No		
279		0 = No		
300		0		
301		0		
302		0		
303		0		
304		0		
305		0		
306	X	0	Infused sum in ml (xxxxyyyy)	[xxxx . . . ml]
307	X	0	Infused sum in ml (xxxxyyyy)	[. . . yyyy ml]
308	X	0	Operating time in min (xxxxyyyy)	[xxxx . . . min]
309	X	0	Operating time in min (xxxxyyyy)	[. . . yyyy min]
310	IV set -1-	999	Max. rate in ml/h (1...999 ml/h)	
311		999	Prime rate in ml/h (1...999 ml/h)	
312		999	Max. bolus rate in ml/h (1...999 ml/h)	
313		10	Max. bolus total in ml (1...99 ml)	
314		0		
315		4	Pressure limit "PrL" default value micro mode	(1..10 * 100 mbar)
316		7	Pressure limit "PrL" default value	(1..10 * 100 mbar)
317		250	Airbubble size (50...1000 µl)	
318		20	Drop-rate window centre in drops/ml (10...65)	
319		1000	Correction (850...1150) ((actual/nominal)*1000)	
320	IV set -2-	999	Max. rate in ml/h (1...999 ml/h)	
321		999	Prime rate in ml/h (1...999 ml/h)	
322		999	Max. bolus rate in ml/h (1...999 ml/h)	
323		10	Max. bolus total in ml (1...99 ml)	
324		0		
325		4	Pressure limit "PrL" default value micro mode	(1..10 * 100 mbar)
326		7	Pressure limit "PrL" default value	(1..10 * 100 mbar)
327		250	Airbubble size (50...1000 µl)	
328		20	Drop-rate window centre in drops/ml (10...65)	
329		1000	Correction (850...1150) ((actual/nominal)*1000)	
330	IV set -3-	999	Max. rate in ml/h (1...999 ml/h)	
331		999	Prime rate in ml/h (1...999 ml/h)	
332		999	Max. bolus rate in ml/h (1...999 ml/h)	
333		10	Max. bolus total in ml (1...99 ml)	
334		0		
335		4	Pressure limit "PrL" default value micro mode	(1..10 * 100 mbar)
336		7	Pressure limit "PrL" default value	(1..10 * 100 mbar)
337		250	Airbubble size (50...1000 µl)	
338		20	Drop-rate window centre in drops/ml (10...65)	
339		1000	Correction (850...1150) ((actual/nominal)*1000)	

Address (#)	Write prot.	Default Value	Function	
340		999	Max. rate in ml/h (1...999 ml/h)	
341		999	Prime rate in ml/h (1...999 ml/h)	
342		999	Max. bolus rate in ml/h (1...999 ml/h)	
343	IV set -4-	10	Max. bolus total in ml (1...99 ml)	
344		0		
345		4	Pressure limit "PrL" default value micro mode	(1..10 * 100 mbar)
346		7	Pressure limit "PrL" default value	(1..10 * 100 mbar)
347		250	Airbubble size (50...1000 µl)	
348		20	Drop-rate window centre in drops/ml (10...65)	
349		1000	Correction (850...1150) ((actual/nominal)*1000)	
360		0		
361		500	Key "ON/OFF" delay (0...3000 msec), (additional key "STOP"] if #4=1)	
362		3	Display brightness (1...3)	
363		10	Buzzer alarm volume (5...10)	
364		0		
365		0		
366		0		
367		0		
368		270	Battery discharge time incl. 15 min prealarm (45...615 min)	
369		5	Automatic menu fall back delay time	(5...30 s)
370		0	Clock seconds	(0...59)
371		0	Clock minutes	(0...59)
372		0	Clock hours	(0...23)
373		0		
374		0	Clock days	(1...31)
375		0	Clock months	(1...12)
376		0	Clock years	(2000...2099)
377		0		
378		0		
379		0		
380	X		Last failure number (F-XX)	
381	X		Last infusion rate at failure	
382	X		2. last failure number (F-XX)	
383	X		2. last infusion rate at failure	
384	X		3. last failure number (F-XX)	
385	X		3. last infusion rate at failure	
386	X		4. last failure number (F-XX)	
387	X		4. last infusion rate at failure	
388	X		5. last failure number (F-XX)	
389	X		5. last infusion rate at failure	
390		0	Last service date (yyww, year and week)	
391	X	0	2. last service date	
392	X	0	3. last service date	
393		0	Service interval in months (1..24, 0 = disabled)	
394		0	Service interval in hours (1..9999, 0 = disabled)	
395		0	Own address for SCI (0=no address, or 1...127)	
396		0	Inventory-no. of the pump (xxxx yyyy)	[xxxx ...]
397		0	Inventory-no. of the pump (xxxx yyyy)	[... yyyy]
398		0		
399	X	414	Data xxxx -> clears protection key	

1.6 Special configuration options

- Configuration of a reminder alarm for the safety standard check:
First the service interval has to be configured either in months or in hours of operation, or both (addresses 393, 394).
Next the last service date has to be entered on address 390. Any value higher than 0 entered at the addresses 393 and/or 394 will release the reminder alarm after the set service interval has elapsed (check also the correct settings of the internal clock).
- PC configuration tool "AConfig":
With this additional software the pump may be configured from a PC over the serial port. This software may be available from your local distributor or our service department.
- IV-set definition:
Allows the individual calibration of up to 4 dedicated IV-sets over the full infusion rate range. Please contact your local distributor or our service department for further information.

After changing the configuration a function check and a control measurement has to be made!

2 History and pump configuration printout

2.1 Connecting of the ARGUS414 to the serial interface

Caution: The infusion pump must be disconnected from the patient before any connection over the serial interface can be done.

A connection of the ARGUS414 to a computer is useful to read the actual configuration or history of the pump. Even a simple monitoring of the pump can be done over the serial interface RS-232.

The connection of the infusion pump with your computer over the interface can be done by connecting the interface cable and adapter (part 12.011 and part 12.012) and the following steps:

- Connect the RS-232 interface cable to outlet (32) of the infusion pump and to the serial port of your PC. Note in which port (COM1 or COM2) you have plugged in.
- Start your terminal program on your computer. A simple terminal program, e.g. "Hyper Terminal" is included in every MS-Windows 9x and Windows NT systems, but must be installed first if necessary.
- Be sure that you have selected the right serial port (COM1 or COM2) and set the following communication parameters:

Bits per second: 4800 Baud
Data bits: 8 bits
Parity: None
Stop bits: 1 bit
Protocol: None

- Go to the next step in one of the further chapters, depending on your intention.

2.2 Configuration printout

- Switch the pump on while keeping the keys "MODE" and "START/STOP" pressed and go in the configuration mode.
- Select address **399** on the left hand display.
- Start capturing text received over the serial interface, e.g. by selecting "capturing text..." in the menu of the Hyper terminal. A text file which contains the actual configuration printout will now be generated.
- Enter the data **3456** on the right display of the pump.
- Press the "START/STOP" key.
- The pump will now transfer the actual configuration of the pump in the format mentioned below.
- Stop the capturing of the text received; this will also close the text file generated.
- The generated text file can be opened and printed out by any text program.

Pump configuration printout (sample)

```
/****** Configuration profile *****/           Wed 19-Jan-2002 11:29:55

Pump type           : ARGUS414
Inventory number    : 0000 0000
Software release     : V1.00 (000719-4061)
Infused sum         : 678ml
Operating time      : 5h32min
Last service date   : 2000 week 12

00=0   50=0   100=0   300=0   320=0400   340=0000   360=0000   380=0000
01=1   51=0   101=0   301=0   321=0000   341=0000   361=0000   381=0000
02=0   52=0   102=0   302=0   322=0000   342=0000   362=0000   382=0000
03=0   53=1   103=1   303=0   323=0000   343=0000   363=0000   383=0000
etc.
```

2.3 History printout

The transfer of the last events made on the pump can be done either by this way:

- Switch the pump on while keeping the key "100" pressed.

Or by this way:

- Switch the pump on while keeping the keys "MODE" and "START/STOP" pressed and go in the configuration mode.
- Select address **399** on the left display of the pump.
- Start capturing text received over the serial interface, e.g. by selecting "capturing text..." in the menu of the Hyper terminal. A text file which contains the history printout will now be generated.
- Enter the data **4567** on the right display of the pump.
- Press the "START/STOP" key.
- The pump will now transfer the last events made on the pump in the format mentioned below.
- Stop the capturing of the text received; this will also close the text file generated.
- The generated text file can be opened and printed out by any text program.

History printout (sample)

```

/***** History *****/      Mon 28-Aug-2000 08:42:44

Pump off                      Mon 28-Aug-2000 11:54:38
Rate   = 123.0ml/h           IV-Set   = 3
Total  = 0050.0ml           PrLimit = 0500mbar
Infsum = 0054.0ml           Status  = 0x0000

Pump on                      Mon 28-Aug-2000 15:01:58
Rate   = 010.0ml/h           IV-Set   = 3
Total  = 0050.0ml           PrLimit = 0500mbar
Infsum = 0009.0ml           Status  = 0x0000
etc.

The possible messages are:

Battery defective             PC configuration done           Too many drops, pump stop
Battery low prealarm         Pump has detected failure        Inf-set change
Battery low, pump stop       Pump off                         Timer alarm, pump stop (KVO)
Bolus start                  Pump on                         Total volume reached, pump stop (KVO)
Bolus stop                   Pump start                      Datalock off
External power off           Pump stop (KVO)                Datalock on
External power on            Rate change                    Infsum cleared
Bolus total reached          Enter setup mode               No drops, pump stop
Occlusion, pump stop          Exit setup mode                Not enough drops, pump stop
PrLimit change               Transport off                   Door open, pump stop
PC configuration failure      Transport on                    Air bubble, pump stop
```

2.4 Monitoring of the ARGUS414

Caution: The monitoring of the infusion pump ARGUS414 over the serial interface of a PC is only for demonstration purposes; any connection with patients has not been tested under the conditions of EN 60601-1 and are not allowed.

- Switch the pump on with an inserted filled infusion set.
- Enter one of the following command directly in your terminal window or transmit the corresponding ASCII code over your own monitoring program. A short sample of a monitoring session is mentioned at the end of this chapter.

Command	Keystrokes in terminal	ASCII code	Description
ENQ	Ctrl+E	05H	Request status (see format below)
SO	Ctrl+N	0EH	Sets pump in remote mode
STX	Ctrl+B	02H	Start of data entry (see format below)*
'data'	Data	-	Data*
ETX	Ctrl+C	03H	End of data entry*
DC2	Ctrl+R	12H	Start infusion*
DC4	Ctrl+T	14H	Stop infusion*
SI	Ctrl+O	0FH	Sets pump in local mode
ACK	Ctrl+F	06H	Alarm suppression (2min)*
FS	Ctrl+\	1CH	Enables/disables KVO*
BEL	Ctrl+G	07H	Toggle "Buzzer at start mode"*
CAN	Ctrl+X	18H	No start tests at next start*
ESC	Ctrl+[1BH	Next character following ESC ("Ctrl+[") will select the pump with address , "addr", if more than one is connected to the serial interface
"addr"	-	0-127	Address (must be the same as in the pump configuration on address 395)* * Only valid in remote mode

Format of "data" entry: **STX 0 1 2 0 0 2 0 0 ETX**

Rate 1E2
Rate 1E1
Rate 1E0
Rate 1E-1
Total 1E3
Total 1E2
Total 1E1
Total 1E0

Format of "status", which will be returned by the pump after typing "Ctrl+E" in the terminal:

STX 0 1 2 0 0 2 0 0 0 0 1 0 7 0 0 0 0 A B C D E ETX

Rate 1E2
Rate 1E1
Rate 1E0
Rate 1E-1
Total 1E3
Total 1E2
Total 1E1
Total 1E0
Infused sum 1E3
Infused sum 1E2
Infused sum 1E1
Infused sum 1E0
PrL 1E3
PrL 1E2
PrL 1E1
PrL 1E0
Medicament 1E1
Medicament 1E0
Statusbyte-1
Statusbyte-2
Statusbyte-3
Statusbyte-4
Statusbyte-5

Format statusbyte-1:

P	1	X	X	X	X	X	X
Parity	Always high	Pump type (0 = A414)	Reserved	Battery active	Battery low prealarm	Battery low, pump stop	Battery defective

Format statusbyte-2:

P	1	X	X	X	X	X	X
Parity	Always high	Occlusion, pump stop	Reserved	Reserved	Reserved	Bottle empty, pump stop	Airbubble, pump stop

Format statusbyte-3:

P	1	X	X	X	X	X	X
Parity	Always high	Remote mode active	Reserved	Global Alarm	Door open	Pump stop (KVO)	KVO active

Format statusbyte-4:

P	1	X	X	X	X	X	X
Parity	Always high	Reserved	Bolus active	Data lock active	Total volume reached, pump stop (KVO)	Timer alarm, pump stop (KVO)	Standby alarm active

Format statusbyte-5:

P	1	X	X	X	X	X	X
Parity	Always high	Pressure indicator (address 46)	Bargraph-LED upper	Bargraph-LED lower+3	Bargraph-LED lower+2	Bargraph-LED lower+1	Bargraph-LED lower

A sample of a monitoring session:

- Switch the pump on with an inserted filled infusion set.
- Type "Ctrl+N" to set the pump in remote mode.
- Type "Ctrl+B", then "01200200" and then "Ctrl+C" which sets the rate to 12.0 ml/h and an infusion total of 200 ml. The rate should now be shown in the left display of the pump.
- Type "Ctrl+R" to start the infusion.
- Type "Ctrl+T" to stop the infusion.

3 Fault finding

The fault code in case of a failure is displayed by pressing "MODE" key (21). (F-XX) appears in display (9), and the source of the failure is listed in the table below:

Error	Error reason	Assembly group
F-21...22	ROM test	Mainboard
F-23...24	RAM test	Mainboard
F-25	CPU test	Mainboard
F-26	Invalid function menu	
F-27	EEPROM data invalid	Mainboard
F-28	RTC (real time clock) data invalid	Mainboard
F-29	Stepper motor power test	Mainboard
F-31	1.2 Volt supply out of range	Mainboard
F-32	5 Volt supply out of range	Mainboard
F-33	30 Volt supply out of range	Mainboard
F-41	Pressure sensor test failed	Pressure sensor or mainboard
F-42	Air detector test failed	Air detector or mainboard
F-43	Air bubble size invalid	Mainboard
F-44...45	Address invalid for EEPROM	Mainboard
F-46	Frequency from μ C or RTC out of range	Mainboard
F-47	Displayboard not present	
F-48	Key(s) too long active	Displayboard
F-49	Set correction invalid	Mainboard
F-50	Pressure monitor	Mainboard or pressure sensor
F-51...56	Rotation control	- Mainboard - Hallboard - Motor - Clutch
F-57...59	Volume control	Mainboard

Exceptionally a fault code may appear, which is not included in this list. In this case we recommend to change the main board.

4 Replacement of parts

4.1 Disassembly of the pump

NOTE: The exploded views in the appendix show the individual mounting steps.

CAUTION!

Switch the unit off and disconnect the mains cable from the power outlet before opening the housing. The antistatic protection have to be strictly adhered to when the ARGUS infusion pump is disassembled (the use of an antistatic table mat and a grounded clip are recommended, for example).

a Disassembly of the hood:

Remove the four screws on the side and on the rear wall, lift hood up and disconnect the plug-type connector of the drop barrier.

b Disassembly of the main printed board assembly:

Disconnect the plug-type connector of the main printed board assembly and unscrew the two lateral attachment screws. Please refer to the wiring diagram in the appendix.

c Disassembly of the front panel:

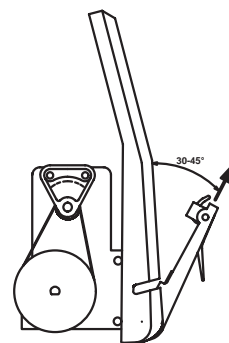
Use a ball-headed hexagon screwdriver to unscrew the two attachment screws from the rear and remove the front panel. This special screwdriver can be obtained from the service department on request.

d Disassembly of the pump unit:

By unscrewing the four attachment screws, the whole pump unit can be removed from the front panel.

e Remove the pump door:

The pump door can be remove without any tools by pulling it out in the direction of the arrow according to the drawing. For the dismounting and the mounting the opening angle from 30 to 45° has to be kept.



4.2 Replacement of the EPROM or the display board

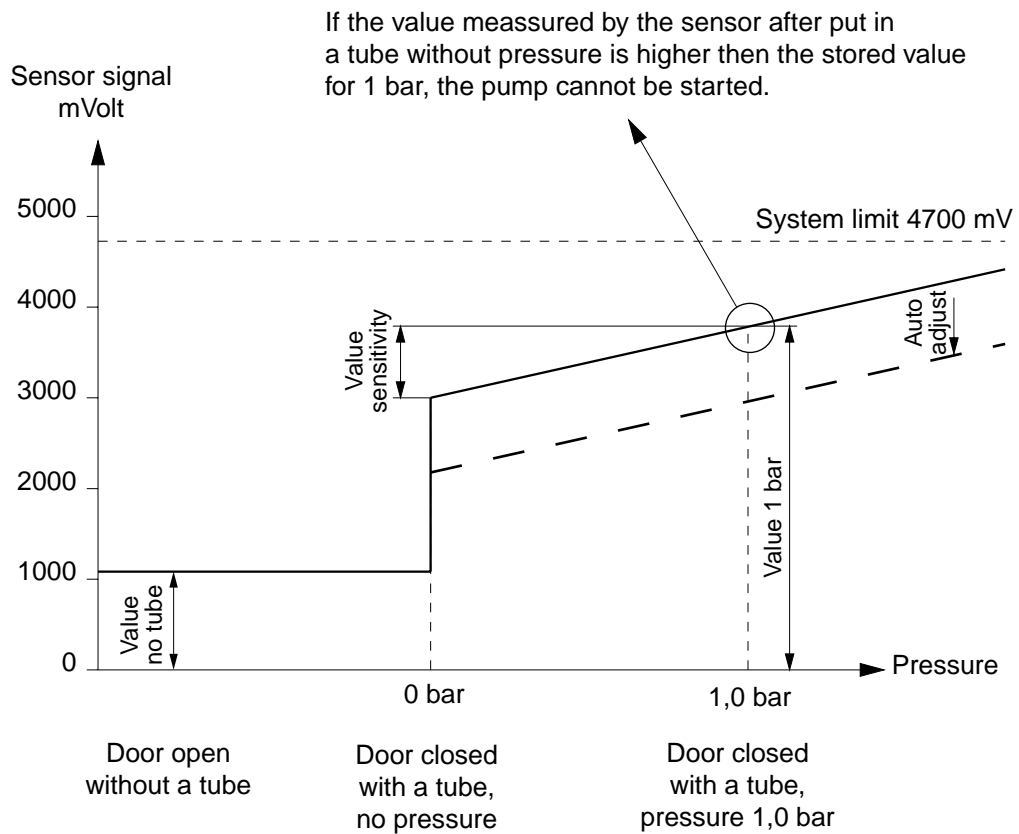
a Software updates may reset automatically the default values in the EEPROM. You are requested to write down the actual contents of the addresses before you replace the EPROM or the display board. Afterwards you have to re-enter these values in the program mode. If a write protection code has been used before, the same code has to be programmed again.

b A pressure sensor calibrating is necessary when replacing the pressure sensor, a pressure sensor calibration and a volume calibration are necessary when replacing the EPROM or the display board. Be careful and carry out the described instructions step by step.

4.3 Pressure sensor calibration

- 1 Go to the program mode (without IV-administration set).
- 2 Enter in address **399** the value **1234**.
- 3 Press the key "START/STOP"
The display shows e.g. [Set] [-2-]. Choose the IV set (no. 1 to 4) by pressing the key [1].
- 4 Press the key "START/STOP" (The pump mechanic runs with a rate of ca. 200 ml/h).
The display shows [CAL.] [door]. By pressing the key "1" it is possible to show the stored value in mV in the display.
- 5 Press the key "START/STOP". The offset voltage, without IV-set, will be stored.
The stored value will be acknowledged by a sound.
- 6 Press the key "MODE".
The display shows [CAL.] [0bAr]. By pressing the key "1" it is possible to show the stored value in mV in the display.
- 7 Install an used (milled) IV-administration set (Open the roller clamp).
- 8 Start the pressure build-up by occluding the tube on the patient side to control the mechanical pressure limit.
Minimum 1.2 bar has to be reached for a successful calibration.
- 9 Gradually decrease the pressure by removing the occlusion.
- 10 Wait ca. 30 sec., then activate the key "START/STOP". The reference value for sensitivity calculation will be stored. The stored value will be acknowledged by a sound.
- 11 Press the key "MODE".
The display shows [CAL.] [1bAr]. By pressing the key "1" it is possible to show the stored value in mV in the display.
- 12 Start the pressure build-up again, wait until the manometer shows 1 bar, then activate the key "START/STOP". The absolute value at 1 bar will be stored. The stored value will be acknowledged by a sound.
- 13 Gradually decrease the pressure.
- 14 Turn the pump off- and on again.
- 15 Select the rate at 500 ml/h.
- 16 Press the key "START/STOP".
- 17 Start the pressure build-up to control the electronic pressure limit.
- 18 The alarm must be activated at ca. 700 mbar \pm 100 mbar if the default value = "7".
If the result is not satisfactory repeat the sensor calibration.
- 19 Switch the pump off.

4.4 Pressure sensor signal



4.5 Volume calibration general

- 1 Go into the program mode.
- 2 Decide which IV set should be calibrate and check its release address.
 - address 101 for IV set no. -1-
 - address 102 for IV set no. -2-
 - address 103 for IV set no. -3-
 - address 104 for IV set no. -4-

Set the correction value in one of the following address to **1000**:

 - address 319 for IV set no. -1-
 - address 329 for IV set no. -2-
 - address 339 for IV set no. -3-
 - address 349 for IV set no. -4-

Switch the pump off and on.
- 3 Select the IV set you like to calibrate and make the following pump settings (for warm up the peristaltic system): Rate = 999 ml/h; volume "total" = 10 ml
Start the pump by pressing "START/STOP" once. Switch the pump off and on again after the volume "total" is reached.
- 4 The next pump settings are:
Rate = 100 ml/h; volume "total" = 25 ml
Start the pump by pressing "START/STOP" once. Switch the pump off immediately after the volume "total" is reached, the net weight result must be 25 g +/-5%.
- 5 Calculate the correction factor with the equation:
Correction factor = (measured volume / preset volume) * 1000
- 6 Go into the program mode and select address for the correction value (see point 1)
Press "MODE" to enter the correction factor in the right hand display.
Press "START/STOP" to acknowledge the correction factor.
Switch the pump off.
- 7 Make a control measurement with the same settings as mentioned in point 4, using the IV-set for which the correction factor has been changed. Perform an occlusion pressure check (see chapter "Pressure sensor calibrating", point 15-19) to verify the pressure alarm level.

4.6 Volume calibration by the integrated program

- 1 Go to the program mode.
- 2 Enter in address 399 the value 123.
- 3 Press the key "START/STOP".
The display shows e.g. [Set] [-2-]. Choose the IV set (no. 1 to 4) by pressing the key [1].
- 4 Press the key "START/STOP".
The display shows [bAL.] [tArA]. The right hand display is flashing.
The pump delivers a volume of 5 ml by a rate of 250 ml/h to warm up the tube.
- 5 The display shows [bAL.] [tArA].
Re-zero the balance.
- 6 Press the key "START/STOP".
The display shows [tM] [xxx].
The pump delivers a volume of 15 ml by a rate of 250 ml/h.
- 7 The display shows [bAL.] [12.75].
Enter the value of the balance into the pump e.g. 14.65.
- 8 Press the key "START/STOP".
The display shows e.g. [Cor.] [977].
- 9 Press the key "START/STOP".
The display shows e.g. [Set] [-2-] and an acknowledgement sound occurs.
The correction factor has been stored in the address of the choosed IV set (see point 3).
- 10 Switch the pump off.
- 11 Make a control measurement with the same settings as mentioned in point 4 using the IV-set for which the correction factor has been changed. Perform an occlusion pressure check (see chapter "Pressure sensor calibrating", point 15-19) to verify the pressure alarm level.

4.7 Calibration of the battery capacity

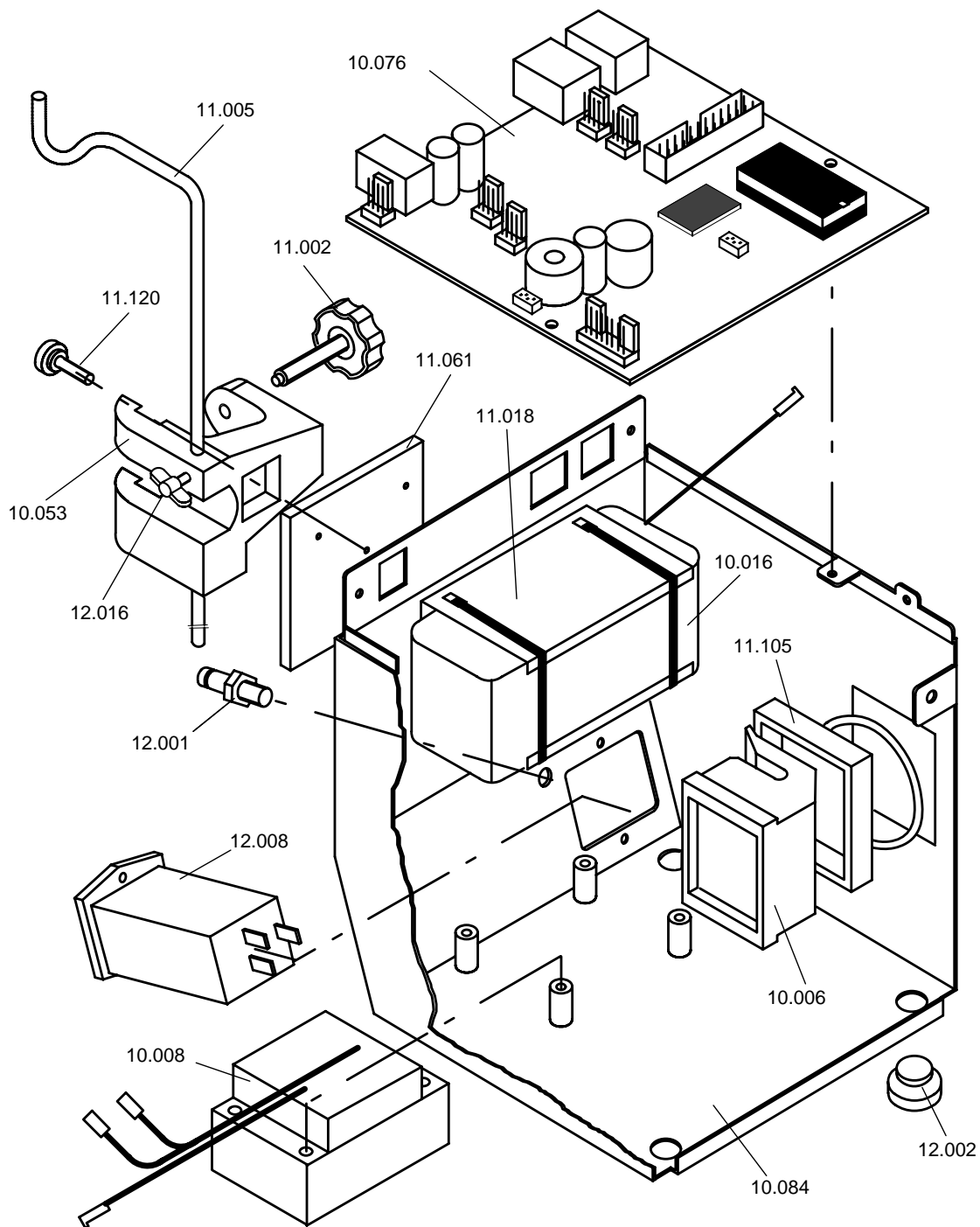
Each battery is subject to a chemical process with a slowly decreasing running time. After many charge and discharge cycles the battery may not have the capacity which provided the running time shown in the menu "CAP".

To adjust the running time of the used battery please follow the steps mentioned below:

- Go in the configuration mode of the pump.
- Select address "368" in the left display.
- Enter the data "615" in the right display and press the "START/STOP" key to accept the data. This will set the battery discharge time to the maximum of >10 hours.
- Switch the pump off.
- Be sure you have unplugged the line connection.
- Switch the pump on normally and let the pump running in battery mode until its self switching off.
- Load the battery for more than 16 hours by plug in the line.
- Switch on the pump and start an infusion with a rate of 60ml/h. The infused sum at this rate is now equal to battery operating time in minutes.
- Leave the pump running until the pump its self switching off again.
- Switch the pump on while keeping the key "1" pressed. The right display now shows the capacity of the battery in minutes. Multiply this time x 0.8 and enter the result on address "368" in the configuration mode. This time defined from now on the running time of the pump including a 15 minutes pre-alarm (only after a full charge).
- If this time is less than 4 hrs, you should replace the battery (part 10.016). If the specific time > 4hrs is not necessary, the battery has to be changed only if the time less than 3hrs, with respect to environ pollution.

5 Safety standard check

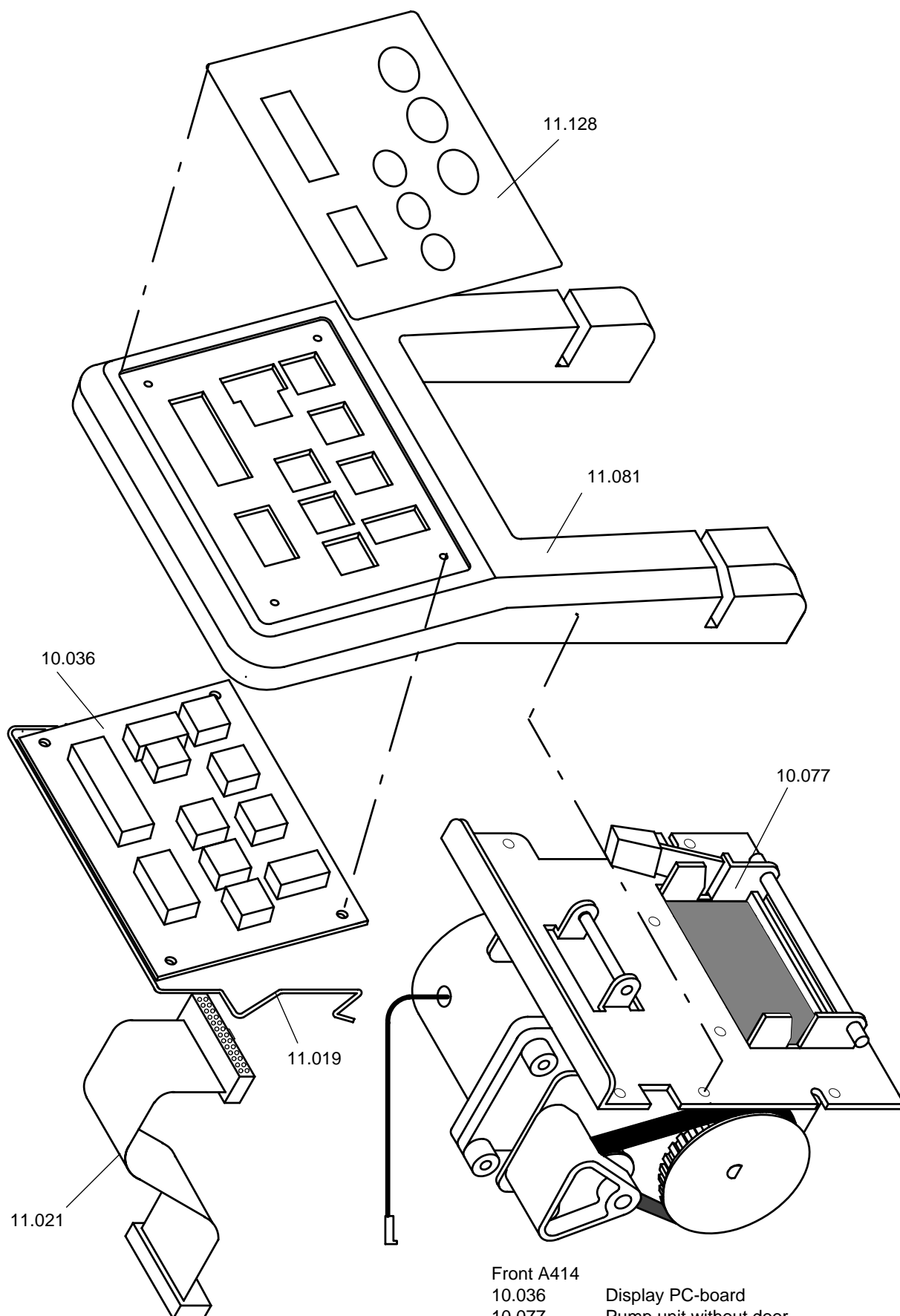
Safety standard check		ARGUS 200	<input type="radio"/>	ARGUS Medical AG
		ARGUS 400	<input type="radio"/>	
		ARGUS 404	<input type="radio"/>	
Serial-no:		ARGUS 414	<input type="radio"/>	
Hospital/Dept./Customer:				
.....				
The safety standard check has to be performed at least every 24 months or after 10000 hours of operation. The check has to be done in accordance to the operation- and service manuals.				
1	Visual check for damage, cleanness and completeness:	- Housing, labels, accessories, connectors, power cable, etc.		<input type="checkbox"/>
2	Test the function of the stop flow lever:			<input type="checkbox"/>
3	Keep key "START" (ARGUS 200/400/404) or "MODE" (ARGUS 414) pressed while switching on the pump.	- Display shows the software release: - Display of 2, 4, 7, F., ml total, ml inf., h.min - Test of the red alarm LEDs: Pressure display, air, battery, drops, ALARM - Test of the green operation LEDs: Line, battery, drops, KVO	V	<input type="checkbox"/>
4	Place a filled tube in the air detector:	- LED air alarm disappeared		<input type="checkbox"/>
5	Set rate to 111 ml/h, press "START/STOP" (without drop detector):	- After 12 sec. the acoustical alarm and LED drop-alarm + LED ALARM released		<input type="checkbox"/>
6	Press key "MODE":	- Acoustical alarm switches off		<input type="checkbox"/>
7	Simulate drops manually:	- LED drops (green) lights up		<input type="checkbox"/>
8	Check of the occlusion-alarm-pressure: Infusion set: Codan Pressure increase to ≥ 1.1 bar? Test of the occlusion-alarm-pressure	- See Service manual "Replacement of parts" Braun Other Preset level: mbar Measured: mbar		<input type="checkbox"/>
9	Check of the pump accuracy: Rate: 250 ml/h Preset volume: 25 ml	- See service manual "Replacement of parts" Measured volume: ml		<input type="checkbox"/>
10	Test the pump at max. rate (999 ml/h):	- Running smooth?		<input type="checkbox"/>
11	Battery check by setting the rate to 60 ml/h, disconnect the line and start the pump: Running time: min (If the specified typical 4hrs of operation are not required, the battery has to be changed only if the time is <3 hrs, due to environmental pollution)	- Green LED battery light? - Battery prealarm after typ. 4 hrs? (Red LED battery alarm + acoustical alarm) - Battery alarm 15 min. after prealarm (Red LED battery alarm + ALARM + alarm acoustically) - After 6 min. the pump switches off		<input type="checkbox"/>
12	Charge the battery min. 16 hrs.			<input type="checkbox"/>
13	Check the external connections:	- Staff alerting system - External drop detector - Computer interface RS232		<input type="checkbox"/>
14	Electrical test according to EN60601-1 (all measurements made with a power cable 2,5 m)	- Measurements attached		<input type="checkbox"/>
The pump has passed the safety standard check and is safe for use.				<input type="checkbox"/>
Date: Name: Signature:				



Casing A414

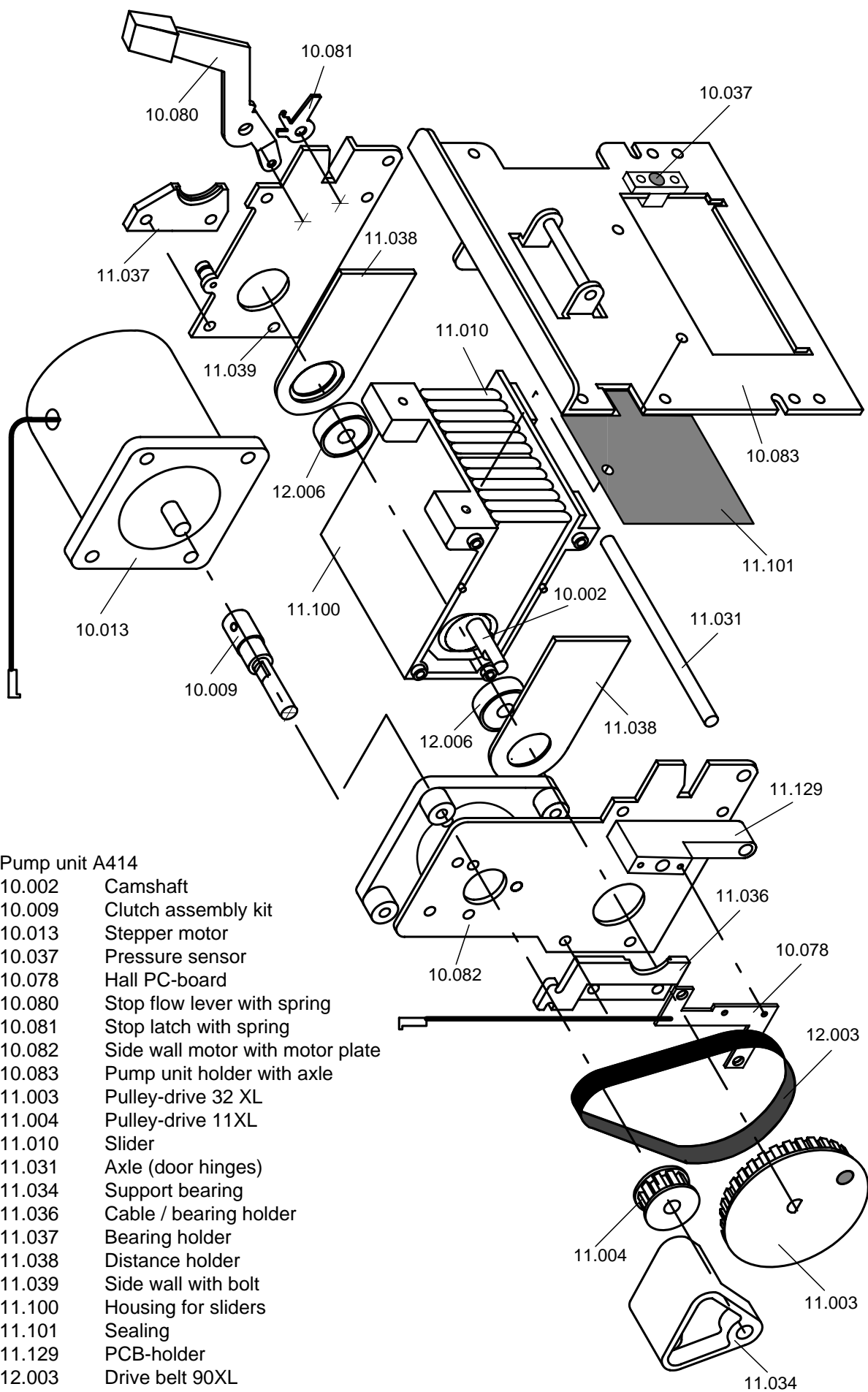
10.006 Air detector with O-sealing
 10.008 Transformer 230V
 10.016 Battery 12V/1,2Ah
 10.053 Clamp with screws
 10.076 Main board ARGUS 414
 10.084 Casing with rubber foot
 11.002 Spindle for pole clamp
 11.005 Bottle holder 450mm
 10.084 Casing with rubber foot
 11.018 Battery holder

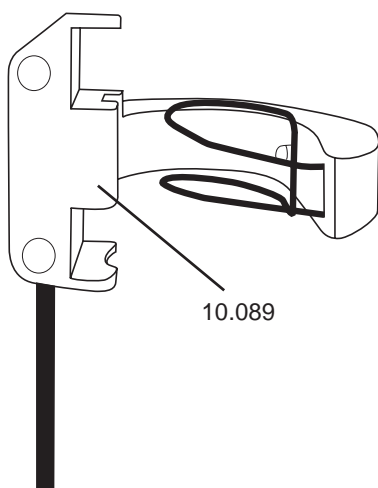
11.105 Sealing
 11.061 Clamp holder
 11.127 Identification plate ARGUS 414
 11.120 Fixing screw M5x20 black
 12.001 Equipotential plug
 12.007 Cable staff alert (opt.)
 12.008 Mains plug with filter
 12.011 RS 232 cable
 12.012 RS 232 adapter
 12.016 Screw for bottle holder



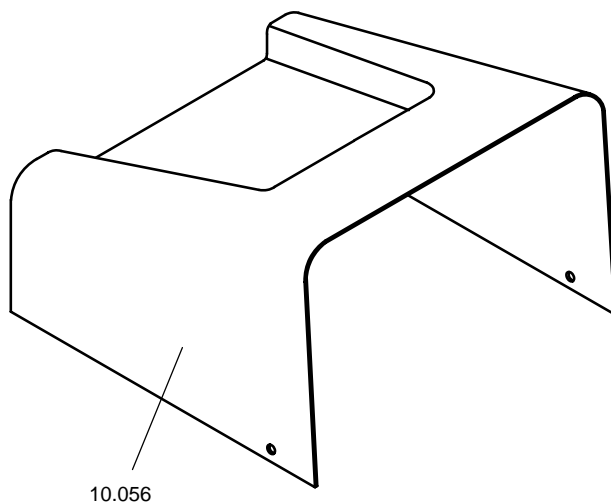
Front A414

- | | |
|--------|------------------------|
| 10.036 | Display PC-board |
| 10.077 | Pump unit without door |
| 11.019 | Spring (Front-housing) |
| 11.021 | Cable assy 26pol |
| 11.081 | Front PVC |
| 11.128 | Frontpanel A414 |

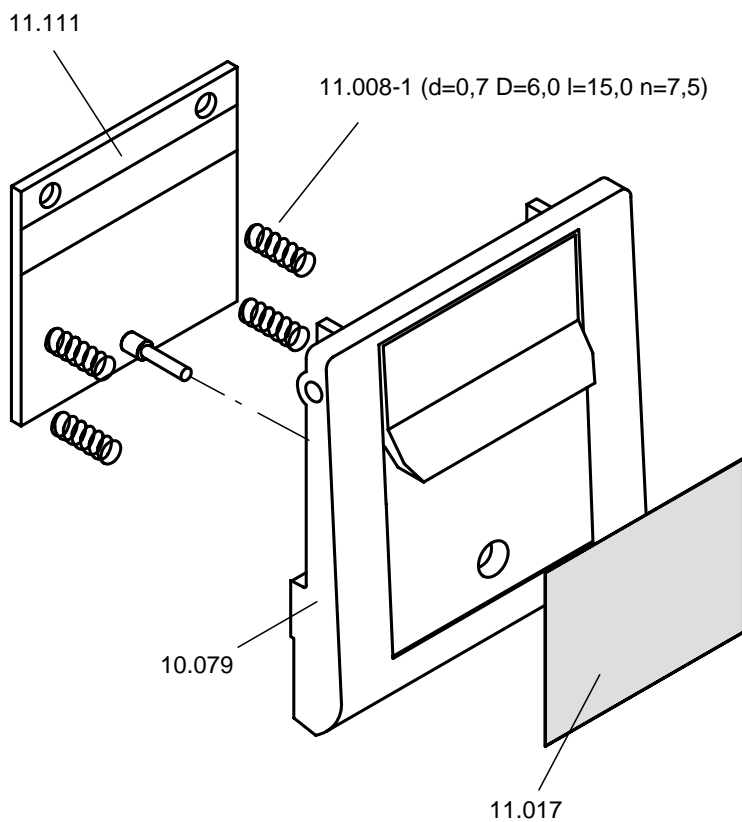




10.089

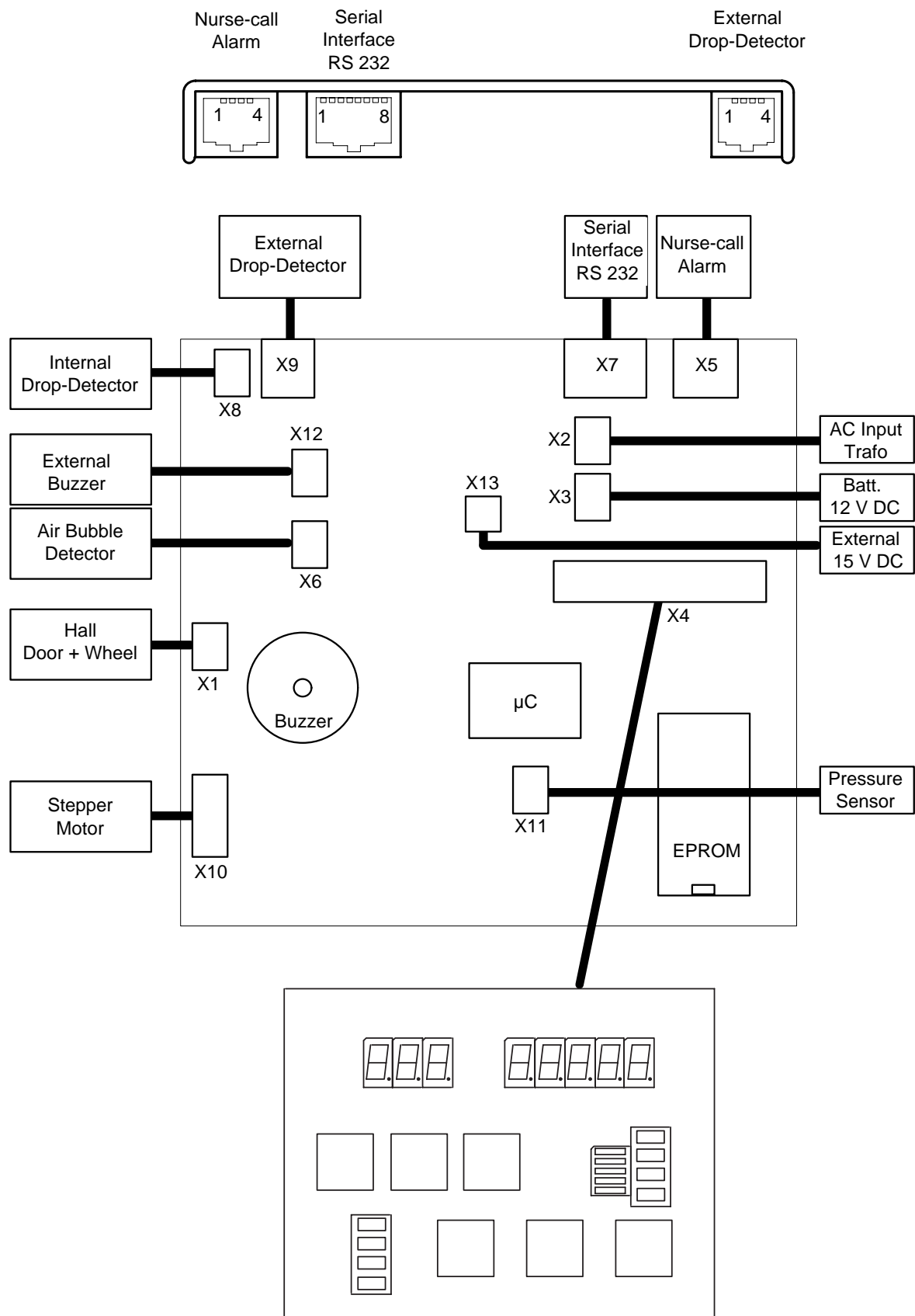


10.056

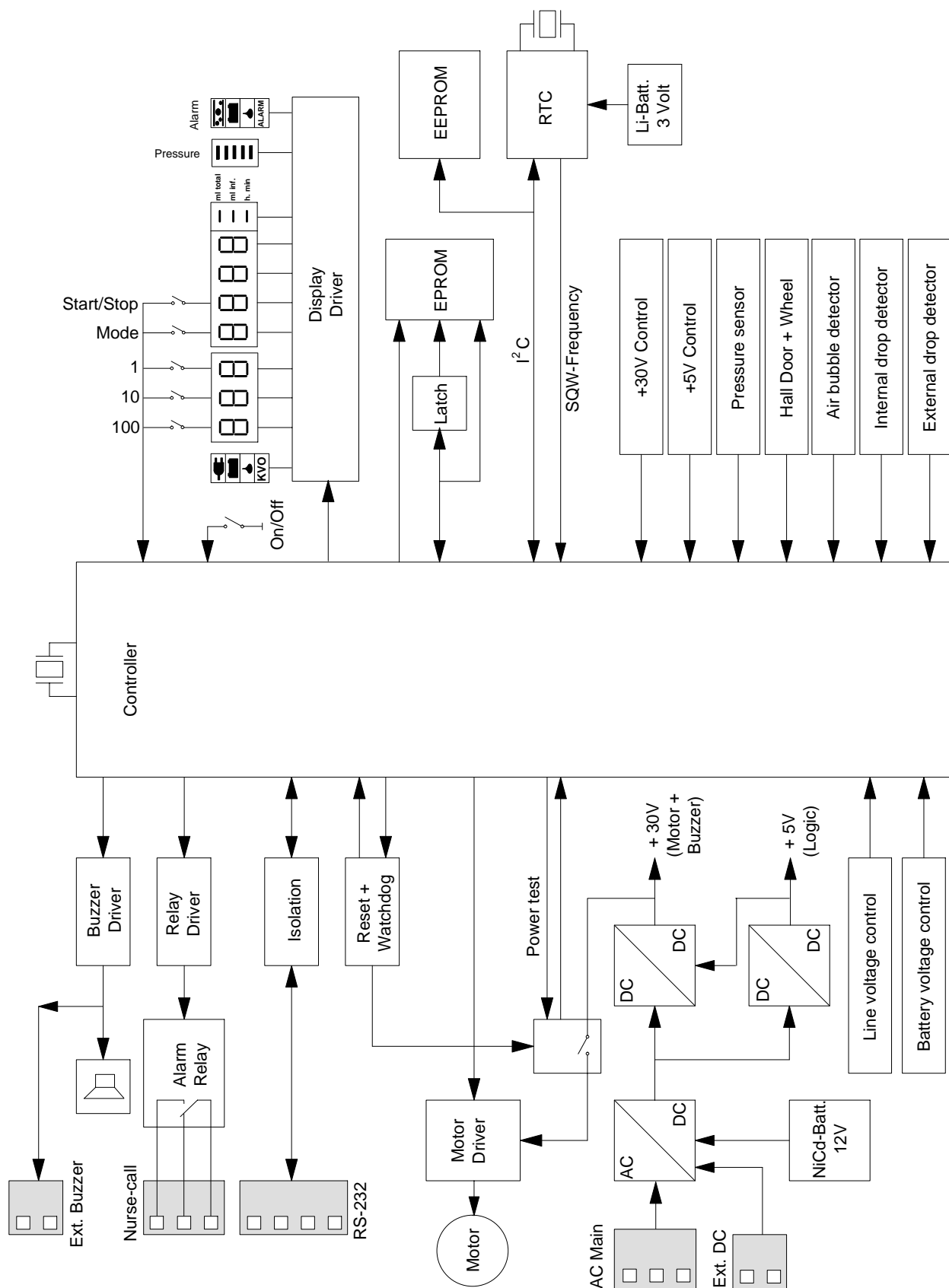


Cover and Door A414

10.056	Cover with magnet
10.050	Door complet
10.079	Door with handle
10.089	External drop detector 01
11.008-1	Pressure spring no. 1
11.017	Door cover
11.111	Counter plate



Wiring diagram



Bloc schematic